

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS

1. (Cancelled)

2. (Original) An apparatus for reading data in an information recording medium containing a plurality of lamination recording sections arranged longitudinally and separated by a plurality of longitudinally extending head seek grooves, said apparatus comprising:

an illumination head device having a light output section shaped to freely couple or decouple from a head alignment groove formed at a light input section of each of said lamination recording sections, and to freely slide in a thickness direction of said information recording medium when being coupled with said head alignment groove for aligning with a recording layer; and

an image data recording device having an imaging element for recording a floating image formed in a space above said information recording medium generated by output light emitted from said illumination head device interacting with a lamination recording section.

3. (Original) An apparatus according to claim 2, wherein said light output section of said illumination head is v-shape in a plan view of said information recording medium.

4. (Original) An apparatus according to claim 2, wherein said imaging element is integrally joined to an elevator actuator for focusing in a direction at right angles to said information recording medium through an elevator support.

5. (Original) An apparatus according to claim 4, wherein said illumination head and said imaging element are provided with respective elevator actuators operatively connected so as to freely receive control signals: from a photo-detector element disposed in opposition to an optical element connected through said illumination head and an optical path, and disposed in said optical path in such way to monitor optical power of reflected return light returning from said lamination recording section; and from an optical means for judging optical power levels according to a pre-determined threshold value and obtaining a total count of traverses made by power levels across said threshold value.

6. (Original) An apparatus according to claim 4, said illumination head and said imaging element are provided with respective elevator actuators operatively connected so as to freely receive control signals: from a photo-detector disposed in lateral proximity to said imaging element for detecting optical power of a floating informational image generated by said information recording medium; and from an optical means for judging optical power levels according to a pre-determined threshold value and obtaining a total count of traverses made by power levels across said threshold value.

7-10. (Cancelled)

11. (Original) An apparatus for reading information recorded on a target waveguide by injecting an input light into a lamination recording section comprised by a plurality of waveguides serving as information recording layers in an information recording medium comprising:

an extreme layer detection device for determining positions of a front waveguide and a rear waveguide in said lamination recording section;

a layer edge detection device for determining positions of a front waveguide edge and a rear waveguide edge; and

a layer position determining device for determining positions of each waveguide and a slanted surface associated with each waveguide edge, according to positions of said front waveguide and said rear waveguide obtained by said extreme layer detection device and positions of said front waveguide edge and said rear waveguide edge obtained by said layer edge detection device.

12. (Original) An apparatus according to claim 11, wherein said apparatus is provided with a focusing device for focusing said input light on a light injection window determined according to positions of a target waveguide in said lamination recording section and a slanted edge associated with said target waveguide.

13. (Original) An apparatus according to claim 12, wherein said focusing device focuses light by positioning a focusing lens.

14. (Original) An apparatus according to claim 12, wherein said focusing device focuses light by positioning a prism.

15. (Original) An apparatus according to claim 12, wherein said focusing device focuses light by positioning a focusing lens and a prism.

16. (Original) An information recording medium structured as a card medium having card framing to contain not less than one longitudinally extending lamination recording section comprised by planar waveguide type information recording layers laminated in a thickness direction of said card medium, and a row of head alignment grooves having respective light injection windows separated by a head seek groove extending longitudinally so as to permit an illumination head to freely travel in said head seek groove to couple with a desired light injection window.

17. (Original) An information recording medium according to claim 16, wherein said head alignment groove is v-shaped.

18. (Original) An information recording medium according to claim 16, wherein said card framing is provided with head positioning markers to indicate positions of said light injection windows or said head alignment grooves.

19. (Original) An information recording medium comprising a data storage disc section having recording sections comprised by a lamination of recording layers distributed in a ring arrangement and a support section for supporting said data storage disc section at its periphery.

20. (Original) An information recording medium according to claim 19, wherein said support section is provided with a rotation mechanism.

21. (Original) An information recording medium according to claim 19, wherein said data storage disc section comprises a column of light injection windows arranged in parallel to a central axis of said disc for injecting light into said recording layers, and a lamination of opposing marker layers surrounding said column of light injection windows.

22. (Original) An information recording medium according to claim 21, wherein said marker layers are arranged in a different interlayer spacing than an interlayer spacing of recording layers in a wedge-shaped recording section.

23. (Original) An information recording medium according to claim 21, wherein said data storage disc section is provided with a position information recording layer containing position information for focusing input light on a light injection window.

24. (Original) An information recording medium according to claim 21, wherein said data storage disc section is comprised by a plurality of discs.

25-34 (Cancelled)

35. (Original) A method for aligning an illumination head for reading information recorded in a laminated information recording medium, having a plurality of data recording layers laminated in a thickness direction of said card medium, comprised by a plurality of lamination recording sections arranged in a longitudinal direction, wherein each lamination recording section has a head alignment groove at a transverse end for coupling with an illumination head having light injection windows for aligning said illumination head with a specific recording layer by sliding in a card thickness direction within said head alignment groove, and rows of lamination recording sections are separated by longitudinal head seek grooves; said method comprising the steps of:

detecting head positioning markers provided on a longitudinal frame of said card medium to correspond to head alignment grooves;

decoupling an illumination head from a head alignment groove and placing in a standby position, and moving said illumination head along a head seek groove to oppose a selected head positioning marker for preliminary head positioning;

positioning said illumination head to a top or bottom window position within said head alignment groove, and coupling to said head alignment groove in a vertical position;

performing rough positioning of said illumination head so that input light is roughly in line with a target light injection window; and

performing precision positioning of said illumination head so that input light is precisely aligned with said target light injection window.

36-38. (Cancelled)

39. (Original) A method for reading data, recorded in laminated information recording medium having a plurality of waveguides as information recording layers, comprising the steps of:

detecting positions of a front waveguide and a rear waveguide as well as input edges associated with each waveguide;

determining positions of each waveguide as well as said input edges according to positions of said front waveguide and said rear waveguide as well as slanted edge surfaces associated with said input edges; and

focusing light on an input light position determined by a position of a target waveguide and a position of a slanted edge surface associated with said target waveguide so as to read data contained in said target waveguide included in said plurality of waveguides.

40-42. (Cancelled)